

Table 1. Details of fishing nets and charges of fish harvest operations in aquaculture farms in Andhra Pradesh

Fishing operation/handling	Observation
Type of fishing nets used	Drag Nets and Cast Nets
Gear material	Nylon multifilament
Drag Net Specifications	20mm mesh size, 350 m length, 9-10m width
Cast Net specifications	20 mm mesh size, 4.4 m length, 4 kg weight
Number of fishermen engaged for aquaculture harvesting (per pond)	6
Wages paid to each fishermen for harvesting (per day)	Rs. 500/-
Fishing Gear hiring charges (per day)	Rs 100 per 100 m length of drag net; Rs 200/- per cast net

the mid-harvest operations (to avoid spread of shrimp diseases). However, fishermen fear that the disinfectants/ sanitizers have adverse impact on the durability of the fishing nets.

Majority of the inland fishermen of Andhra Pradesh (Fig. 1) are distributed in Krishna (13.8%), East Godavari (13.5%), West Godavari (13.2%) and Nellore (10.7%) districts and it is pertinent to note that these districts viz., West Godavari (37%), Krishna (36%), East Godavari (9%) and Nellore (6.7%) have relatively higher

area under aquaculture. This clearly indicates a direct relationship between farm spread area and the number of inland fishermen. The potential area for brackish water aquaculture is 1.74 lakh hectares and 8 lakh hectares for freshwater aquaculture indicating scope for further increase in brackish water and freshwater aquaculture from the existing farm spread area in the state. This opens more opportunities to the fishermen as harvesters of aquaculture produce.



Antimicrobial activity of seaweed extracts of *Padina gymnospora* extracted by supercritical and conventional method

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The interest in replacement of synthetic food preservatives with natural ones received much attention in recent years due to the concern on toxicity and safety. The extended use of synthetic preservation leads to adverse health effects such as liver damage and suspected to be mutagenic and neurotoxic. Hence, most of the consumers prefer additive free foods or natural preservatives from plants, algae and microalgae.

Nowadays, seaweeds are of emerging interest in both food and pharmaceutical industry due to the presence of bioactive compounds with economic relevance including polysaccharides, iodine organic products, macro and micro-elements, vitamins, and unsaturated fatty acids (FAs). Several studies have shown that seaweed or its extracts possess physiological such as antioxidants, antimicrobials, anti-coagulants,

anti-thrombotics, and anti-inflammatory for the treatment of several diseases, in addition to their anti-tumor and anti-viral properties.

The extraction of bioactive compounds from seaweeds is usually performed using organic solvents but these methods have major drawbacks; they use large quantity of organic toxic compounds, labour intensive, long extraction time and low extraction yields. Supercritical fluid extraction (SFE) is an alternative extraction technique over the traditional solvent extraction. SFE is considered as environmental friendly technology, since concentration step is most often eliminated after the extraction process. Moreover, supercritical CO₂ has low viscosity, low surface tension, high diffusivity and good density and is also non-toxic, non-flammable, cheap, widely available, chemically inert under several conditions, and gaseous at normal pressure and temperature (Goto *et al.*, 2015). This technology is well-known today and is considered as a green process. Comparing with the conventional means, SFE exhibited great potential in extracting bioactive compounds especially in terms of yield, phenolic compounds and other antimicrobial compounds. The advantage of supercritical CO₂ extracts over conventional extracts is that supercritical CO₂ extracts can be directly used by the food industry since no toxic solvents are present.

Padina gymnospora is a brown seaweed and is commonly found in the tropical countries, and is distributed along Indian coast. It has demonstrated significant antimicrobial activity against several pathogens and used for the treatment of cutaneous diseases (Baliano *et al.*, 2016). The present study was carried out to compare the antimicrobial efficiency of *Padina gymnospora* extracts, prepared using supercritical and conventional methods. The SFE conditions used was temp 40°C, pressure 225 bar and time 45 min with ethanol as co solvent. Conventional extraction was carried out

by solvent based extraction using 40% methanol and 40% ethanol.

The antimicrobial activity of extracts of *P. gymnospora* were assessed using the micro titer-plate-based dilution method against bacterial strains including *Pseudomonas aeruginosa* ATCC 27853, *E.coli* ATCC 25922, *Salmonella enterica* sub sp. *enterica* serovar Enteritidis ATCC 13076, *Listeria monocytogenes* ATCC 19112 and *Staphylococcus aureus* ATCC 25923. All these cultures were grown in Brain Heart Infusion (BHI) broth for 18-24 hr. After centrifugation at 8000rpm for 15min, the cultures were washed twice in sterile phosphate buffer and suspended in same buffer. The turbidity of the suspension was adjusted to 0.5Mc Farland standard corresponding to 10⁸ cfu/ml. A 1:10 dilution of cell suspension (10⁷cfu/ml) was used for the study.

The results indicated that, the supercritical CO₂ extract had strong antimicrobial activity against all the five bacterial strains studied (Table.1). Highest activity was found against *L. monocytogenes* (31.2 µg/ml), followed by *S. aureus* and *P. aeruginosa* (62.5 µg/ml), *S. enteritidis* (125 µg/ml) and *E.coli* (250 µg/ml) respectively. Generally antimicrobials are less effective against gram negative bacteria because of their more complex multilayered cell wall structure which makes it difficult for the active components to penetrate. However, the supercritical CO₂ extract obtained from *P. gymnospora* showed excellent antimicrobial activity against gram negative as well as gram positive bacteria. Methanol extracts also showed a noticeable activity against all the bacterial strains tested, but lesser active than supercritical CO₂ extracts. Ethanolic extracts showed activity only against *S. aureus*, *P. aeruginosa* and *L. monocytogenes* (250 µg/ml) and no activity was reported against *S. Enteritidis*, a major food borne bacteria.

Overall results indicated that the supercritical extracts of brown seaweed *P.*

Extract	MIC ($\mu\text{g/ml}$)				
	<i>P. aeruginosa</i>	<i>E. coli</i>	<i>S. Enteritidis</i>	<i>L. monocytogenes</i>	<i>S. aureus</i>
Supercritical CO ₂ extract	62.5	250	125	31.2	62.5
40% methanol	125	250	500	250	250
40% Ethanol	250	1000	>1000	250	250

gymnospora exhibited high antimicrobial activity followed by methanol and ethanol extracts. The study showed the extraction efficiency of SFE for extraction of antimicrobial compounds and was found superior than the conventional extraction. Employing a moderate pressure and temperature might have helped in extracting compounds of high antimicrobial activity. Similar results were reported by Mendiola et al (2007). The present study indicates that SFE extracts of *P. gymnospora* have promising applications in enhancing the food safety

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A review of drivers and barriers to fish consumption based on Theory of Planned Behaviour

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Most Keralites have a positive attitude towards seafood and consider it as an important part of healthy and balanced diet. The annual per capita consumption of fish for the entire Indian population is estimated at 5-6 kg whereas for the fish eating population it is found to be 8-9 kg. Average annual per capita fish consumption is highest in Kerala state at 30 kg which is very high when compared to that of other states of India

(Shyam, *et al.* 2015). Issues of fish adulteration have been widely discussed by media and have created an increased health, safety and quality consciousness among consumers. These issues have created new drivers and barriers to fish consumption with consumers changing their fish purchase behaviour and market choices. The article studies the emerging drivers and barriers to fish consumption using 'Theory of Planned